Bleeding Risk

Definition

Bleeding risk refers to the **likelihood that a patient will experience hemorrhagic complications**, either spontaneously or as a result of surgical procedures or medications (e.g., anticoagulants, antiplatelets, NSAIDs).

It is a critical consideration in **perioperative planning**, pain management, and in the use of drugs that affect coagulation or platelet function.

Risk Stratification

High Bleeding Risk

- Intracranial surgery (e.g., craniotomy, tumor resection)
- Spinal surgery
- Recent gastrointestinal bleeding
- Active peptic ulcer
- Severe thrombocytopenia (<50,000/µL)
- INR > 1.5 or aPTT > 1.5× normal
- Dual antiplatelet therapy
- Use of NSAIDs + anticoagulants
- Liver failure or known coagulopathy

Moderate Bleeding Risk

- Biopsy procedures
- Endoscopic interventions
- Minor orthopedic surgery
- Single-agent antiplatelet therapy
- INR 1.2–1.5

Low Bleeding Risk

- Superficial skin procedures
- Ophthalmic surgery
- Dental extractions
- No anticoagulant or antiplatelet use
- Normal platelet count and coagulation profile

Drug-Related Considerations

Drug Class	Mechanism	Bleeding Risk
NSAIDs (non-selective)	COX-1 inhibition → ↓ platelet aggregation	Mild to moderate ↑
COX-2 inhibitors	Minimal effect on platelets	Low ↑
Aspirin	Irreversible COX-1 inhibition	Moderate ↑ (dose-dependent)
Clopidogrel, Ticagrelor	P2Y12 receptor blockade	High ↑
Warfarin	Vitamin K antagonist	High ↑
DOACs (apixaban, rivaroxaban)	Direct factor Xa inhibition	High ↑
Heparins	Antithrombin-mediated inhibition	High ↑

Relevance in Neurosurgery

- Even **minor bleeding** can have **devastating neurological consequences**
- **NSAID use** post-craniotomy must be carefully assessed:
    1. Meta-analysis (Cardoso et al., 2025) shows **no significant increase** in postoperative bleeding with NSAIDs vs. non-NSAIDs
- Always weigh **analgesic benefit** vs. **hemorrhagic risk**

Assessment Tools (Optional)

- HAS-BLED (for atrial fibrillation anticoagulation risk)
- Preoperative coagulation panel: INR, aPTT, platelets
- Review of medication history (esp. over-the-counter NSAIDs)

Prevention and Management

- Preoperative risk stratification
- Avoid high-risk medications in high-bleeding-risk surgeries
- Optimize hemostasis intraoperatively
- Use reversal agents if needed (e.g., vitamin K, PCC, platelets)
- Monitor closely in ICU or step-down units

Summary

Bleeding risk is a dynamic, multifactorial concept. Its proper assessment is essential to balancing the **efficacy and safety** of surgical procedures and medications—especially in **high-stakes fields like neurosurgery**.

Systematic Reviews and Meta-Analysis

Concerns remain about their safety, particularly regarding the risk of postoperative bleeding because of cyclooxygenase inhibition. A Systematic Review and Meta-Analysis aimed to evaluate whether NSAIDs increase the risk of hemorrhagic complications after craniotomy for brain surgery when compared with non-NSAID approaches or placebo.

A systematic search was conducted in PubMed, Scopus, Web of Science, and Cochrane databases to identify studies comparing NSAIDs with non-NSAID drugs for postoperative analgesia after craniotomy for brain surgery. End points were (1) all bleeding complications and (2) bleeding complications requiring surgical intervention. Subanalyses focused on randomized controlled trials (RCTs) and patients undergoing tumor resection. Risk ratios (RR) and risk difference (RD) with 95% CI were pooled using a random-effects model, and heterogeneity was assessed with the I2 statistic.

Seven studies (5 RCTs), including 2251 patients (1119 males; median ages ranging from 11 to 55 years), of whom 583 (25.9%) received NSAIDs, met the inclusion criteria. Surgical indications included tumor resection, aneurysm clipping, and microsurgery for brain arteriovenous malformations. No significant differences were observed between NSAID and non-NSAID groups for overall bleeding complications (RR: 1.05; 95% CI: 0.58, 1.93; I2 = 0%; RD: 0.31%; 95% CI: -1.46%, 0.84%) or bleeding complications requiring surgical intervention (RR: 1.27; 95% CI: 0.51, 3.16; I2 = 0%; RD: 0.03%; 95% CI: -0.90%, 0.97%). Similar results were found in the RCT-only and tumor resection subanalyses.

The findings suggest that NSAIDs are a safe option for postoperative analgesia in patients undergoing craniotomy for brain surgery, because they do not significantly increase the risk of bleeding complications, including those requiring neurosurgical intervention, compared with non-NSAID analgesics [1)].

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1)
Cardoso LJC, Ferreira MY, Faria IC, Martins KAM, Calisaya-Madariaga IG, Teixeira IPS, Teixeira EM, Suffren B, Oliveira FGF, Croft Z, Rychen J, Ferreira C, Martinez-Perez R, Langer D, Boockvar JA. Do Nonsteroidal Anti-Inflammatory Drugs Increase Bleeding Risk After Craniotomy for Brain Surgery? A Systematic Review and Meta-Analysis. Neurosurgery. 2025 Jun 2. doi: 10.1227/neu.0000000000003541. Epub ahead of print. PMID: 40454849.